

REMARKS

In response to the Office Action mailed August 9, 2006, the Applicants respectfully request reconsideration. To further the prosecution of this Application, Applicants submit the following remarks and have added new claims. The claims as now presented are believed to be in allowable condition.

Claims 1-12, 14-16, and 21-31 were pending in this Application. Claims 32-35 have been added. Accordingly, claims 1-12, 14-16, and 21-35 are now pending in this Application. No new matter has been added to the application by the amendments. Claims 1, 4, 5, and 14 are independent claims.

Allowed Claims

Claim 31 was objected to as being dependent on a rejected base claim but was deemed allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims.

The Applicants reserve the right to amend claim 31 as described above until the Applicants receive a reply to Applicants' request for reconsideration of claims 1, 4, 5, and 14.

Preliminary Matters

The Office Action has not specifically provided support or a reason for the rejection of claim 29 in the "Detailed Action" section.

In the Office Action Summary under the "Disposition of Claims" section of the Office Action, claims 1-12, 14-16, and 21-30 are listed as rejected. However, in the "Detailed Action" section of the Office Action, the Office Action only provides support for the rejection of claims 5, 14, 16, 25, and 26 under 35 U.S.C. §102(a) and claims 1-4, 6-9, 10-12, 15, 21-24, 27, 28 and 30 under 35 U.S.C. §103(a).

Because the Office Action has not specifically provided support or a reason for the rejection of claim 29 in the “Detailed Action” section, the Applicants believe claim 29 to be in a condition for allowance.

Rejections under §102 and §103

Claims 5, 14, 16, 25, and 26 were rejected under 35 U.S.C. §102(a) as being anticipated by U.S. Patent Publication No. US2003/0174478 to Oggioni et al. (hereafter Oggioni). Claims 1-4, 6-8, 10-12, 15, 21-24, 27, 28 and 30 were rejected under 35 U.S.C. §103(a) as being unpatentable over Oggioni in view of U.S. Patent Publication No. US2003/0122242 to Takeuchi (hereafter Takeuchi). Claim 9 was rejected under Oggioni in view of Takeuchi and further in view of U.S. Patent Publication No. US2004/0150102 to Lee et al. (hereafter Lee). The Applicants respectfully traverse each of these rejections and request reconsideration. The claims are in allowable condition.

Independent claims 5 and 14 were rejected under 35 U.S.C. §102(a) as being anticipated by Oggioni.

Claim 5 relates to a circuit board component. The circuit board component comprises a substrate having non-conductive material and conductive material supported by the non-conductive material, the conductive material defining (i) a circuit board interface, (ii) a die interface, (iii) a heat spreader interface, and (iv) a set of connections which interconnects the circuit board interface, the die interface and the heat spreader interface. The circuit board component comprises a die coupled to the die interface defined by the conductive material of the substrate, the die including integrated circuitry which is configured to electrically communicate with a circuit board when the circuit board couples to the circuit board interface defined by the conductive material of the substrate. The circuit board comprises a heat spreader coupled to the heat

spreader interface defined by the conductive material of the substrate, the heat spreader being configured to dissipate heat from the die, the heat spreader in combination with the heat spreader interface forming an electromagnetic interference shield when a portion of the circuit board interface connects to a ground reference of the circuit board through the circuit board interface. The die is disposed between the heat spreader and the substrate. The circuit board component is an Application Specific Integrated Circuit device.

Claim 14 relates to a circuit board component. The circuit board component comprises a heat spreader configured to dissipate heat from the circuit board component. The circuit board component comprises a substrate having non-conductive material and conductive material supported by the non-conductive material, the conductive material defining (i) a circuit board interface, (ii) a die interface, (iii) heat spreader connecting means for physically and electrically connecting to the heat spreader, and (iv) a set of connections which interconnects the circuit board interface, the die interface and the heat spreader connecting means, wherein the heat spreader and the heat spreader connecting means form an electromagnetic interference shield when a portion of the circuit board interface connects to a ground reference of a circuit board through the circuit board interface. The circuit board component comprises a die coupled to the die interface defined by the conductive material of the substrate, the die including integrated circuitry which is configured to electrically communicate with the circuit board when the circuit board couples to the circuit board interface defined by the conductive material of the substrate. The die is disposed between the heat spreader and the substrate. The circuit board component is an Application Specific Integrated Circuit device.

Each of claims 5 and 14 recite a die as being disposed between a heat spreader and a substrate. In the rejection of independent claims 5 and 14, on pages 4 and 8, the Office Action relies on Figures 3 and 4 of Oggioni as teaching

a circuit board component having a die disposed between a heat spreader and a substrate. However, claims 5 and 14 are patentable over Oggioni because Oggioni does not teach or suggest a die disposed between a heat spreader and a substrate, as claimed by the Applicants.

With respect to Figure 3 of Oggioni, Oggioni describes:

[t]he active element 301 must be completely surrounded by the Faraday Cage in order to be shielded from the HF electromagnetic waves. The lateral sides of the Cage are constituted as explained above by the plated through holes 201, and by the solder balls 202 connected together. The **through holes 201 provide a shielding within the substrate** (which is according to the preferred embodiment an organic laminate), while the solder balls ensure a lateral protection between the substrate and the main board (when the module is finally mounted on the board). The ground plane 303 in the main board, properly connected to the solder balls 203, will constitute the lower side of the Faraday Cage, while the upper side, according to the preferred embodiment, will be realized by connecting the top metal plate 305, which usually constitutes the top side of a Cavity Down module, with the through holes 201.

Paragraph 0010 (emphasis added).

The Office Action is not specific as to how the elements of Oggioni's Figure 3 correlate with the claim elements of claims 5 and 14. For the present Amendment, the Applicants assume that the top metal plate 305 in Oggioni can be considered as relating to the Applicants' heat spreader as claimed in claims 5 and 14. As such, Oggioni's Figure 3 does not illustrate a die disposed *between* a heat spreader and a substrate, as claimed by the Applicants. In Oggioni's Figure 3, the active element 301 is merely mounted *beneath* the metal plate 305 and is *surrounded by* the substrate (e.g., the substrate having the through holes and the substrate disposed around all four sides of the active element 301).

Furthermore, the main board shown in Oggioni's Figure 3 cannot properly be considered as a substrate as claimed by the Applicants. Taking the Applicants' claim 5 as an example, claim 5 recites "a substrate having non-

conductive material and conductive material supported by the non-conductive material, the conductive material defining (i) a circuit board interface, (ii) a die interface, (iii) a heat spreader interface, and (iv) a set of connections which interconnects the circuit board interface, the die interface and the heat spreader interface." Oggioni does not teach or suggest the main board of Figure 3 as having a conductive material defining (i) a circuit board interface, (ii) a die interface, (iii) a heat spreader interface, and (iv) a set of connections which interconnects the circuit board interface, the die interface and the heat spreader interface. As such, the Applicants believe that the interpretation of Oggioni's Figure 3 showing the active element 301 being mounted *beneath* the metal plate 305 and *surrounded by* the substrate is correct. As such, Oggioni's Figure 3 does not illustrate a die disposed *between* a heat spreader and a substrate, as claimed by the Applicants.

With respect to Oggioni's Figure 4, Oggioni describes a package having a thin dielectric layer 403 that is laid on a metal (e.g. copper) stiffener 401. A chip 407 is attached on the same side of the dielectric layer 403 and the electrical connections between the chip and the pads 409 are done with metallic traces running on the surface of the dielectric layer 403.

The Office Action is not specific as to how the elements of Oggioni's Figure 4 correlate with the claim elements of claims 5 and 14. For the sake of argument, the Applicants assume that the metal stiffener 401 in Oggioni can be considered as relating to the Applicants' heat spreader as claimed in claims 5 and 14 and that the dielectric layer 403 can be considered as relating to the Applicants' substrate. As such, Oggioni's Figure 4 does not illustrate a die disposed between a heat spreader and a substrate, as claimed by the Applicants. Instead, Oggioni's Figure 4 merely illustrates a chip 407 disposed beneath the dielectric layer 403 and beneath the stiffener 401.

Because Oggioni does not suggest or disclose every element of the Applicants' independent claims 5 or 14, the claims are patentable over the reference and the rejection of claims 5 and 14 under 35 U.S.C. §102(a) should be withdrawn. Accordingly, claims 5 and 14 are in allowable condition. Furthermore, because claims 6-12, 23, and 24 depend from and further limit claim 5, and because claims 15, 16, 25, and 26 depend from and further limit claim 14, claims 6-12, 15, 16, and 23-26 are in allowable condition for at least the same reasons.

The Office Action also rejected independent claims 1 and 4 under 35 U.S.C. §103(a) as being unpatentable over Oggioni in view of Takeuchi.

Claim 1 relates to a circuit board module, comprising a circuit board having a component mounting location and a circuit board component mounted to the component mounting location of the circuit board. The circuit board component includes a substrate having non-conductive material and conductive material supported by the non-conductive material, the conductive material defining (i) a circuit board interface, (ii) a die interface, (iii) a heat spreader interface, and (iv) a set of connections which interconnects the circuit board interface, the die interface and the heat spreader interface. The circuit board component includes a die coupled to the die interface defined by the conductive material of the substrate, the die including integrated circuitry which is configured to electrically communicate with the circuit board when the circuit board couples to the circuit board interface defined by the conductive material of the substrate. The circuit board component includes a heat spreader coupled to the heat spreader interface defined by the conductive material of the substrate, the heat spreader being configured to dissipate heat from the die, the heat spreader in combination with the heat spreader interface forming an electromagnetic interference shield when a portion of the circuit board interface connects to a ground reference of the circuit board through the circuit board interface. The

circuit board component includes a heat sink in thermal communication with the heat spreader of the circuit board component. The die is disposed between the heat spreader and the substrate. The circuit board component is an Application Specific Integrated Circuit device.

Claim 4 relates to a circuit board module, comprising a circuit board having a component mounting location and a circuit board component mounted to the component mounting location of the circuit board. The circuit board component includes a heat spreader configured to dissipate heat from the circuit board component. The circuit board component includes a substrate having non-conductive material and conductive material supported by the non-conductive material, the conductive material defining (i) a circuit board interface, (ii) a die interface, (iii) heat spreader connecting means for physically and electrically connecting to the heat spreader, and (iv) a set of connections which interconnects the circuit board interface, the die interface and the heat spreader connecting means, wherein the heat spreader and the heat spreader connecting means form an electromagnetic interference shield when a portion of the circuit board interface connects to a ground reference of the circuit board through the circuit board interface. The circuit board component includes a die coupled to the die interface defined by the conductive material of the substrate, the die including integrated circuitry which is configured to electrically communicate with the circuit board when the circuit board couples to the circuit board interface defined by the conductive material of the substrate. The circuit board component includes a heat sink in thermal communication with the heat spreader of the circuit board component. The die is disposed between the heat spreader and the substrate. The circuit board component is an Application Specific Integrated Circuit device.

In the rejection of independent claim 1 (on page 5) and claim 4 (on page 8), the Office Action relies on Takeuchi as disclosing a heat sink in thermal

communication with the heat spreader of a circuit board module. Additionally, the Office Action relies on Figures 3 and 4 of Oggioni as teaching a circuit board module having a die disposed between a heat spreader and a substrate. However, as with independent claims 5 and 14 above, Oggioni does not teach or suggest a die disposed between a heat spreader and a substrate, as claimed by the Applicants. Oggioni merely discloses, in Figure 3, an active element 301 being mounted *beneath* a metal plate 305 and *surrounded by* a substrate (e.g., around all four sides of the active element 301) and, in Figure 4, a chip 407 disposed beneath a dielectric layer 403 and beneath a stiffener 401.

Furthermore, there is no motivation to combine Oggioni and Takeuchi to form the circuit board module as claimed in independent claims 1 and 4.

Oggioni relates to a package for High Frequency applications that allows for reduction in the overall thickness of the package, by tailoring the different mechanical portions of the module structure (interconnection balls, grounded stiffener thickness). Paragraph 0032. In Oggioni a chip 407 is attached on the same side of the dielectric layer 403 and the electrical connections between the chip and the pads 409 are done with metallic traces running on the surface of the dielectric layer 403. Each pad 409 is provided with a solder ball 411 for mounting on a mother board as explained with reference to the prior art BGA modules. The external rows of balls 413 are not connected to the circuit traces; they are electrically connected to the metal stiffener 401 to realize the lateral shielding for the HF applications, as explained with reference to patent application EP-A-872888. Paragraph 0035. Oggioni recites that patent application EP-A-872888 teaches that a ground plane 303 of a main board, properly connected to the solder balls, will constitute the lower side of a Faraday cage. Paragraph 0010.

Takeuchi relates to a semiconductor package having an integrated heat spreader. Takeuchi describes the use of a heat sink 606 attached to the top surface of the heat spreader to assist with heat removal. Paragraph 0023.

However, there is no motivation to combine the heat sink of Takeuchi with the package of Oggioni because the modification of the package of package of Oggioni would render the package unsatisfactory for its intended purpose. The purpose of the configuration of the package of Oggioni is to minimize the overall size of the package, such as for use in portable devices where a thickness of 1.2 mm and lower is an objective as described in Oggioni's Paragraph 0015. Inclusion of the heat sink of Takeuchi with the package of Oggioni would increase the overall thickness of the package. As such, the addition of the heat sink to the package of Oggioni would render the package unsatisfactory for its intended purpose - to minimize the size of the package.

Because neither Oggioni nor Takeuchi, either alone or in combination, suggest or disclose every element of the Applicants' independent claim 1 or 4 and because there is no motivation to combine Oggioni and Takeuchi, the claims are patentable over the references and the rejection of claims 1 and 4 under 35 U.S.C. §103(a) should be withdrawn. Accordingly, claims 1 and 4 are in allowable condition. Additionally, claims 2, 3, 21, 22, and 30, which depend from claim 1, and claims 27 and 28, which depend from claim 4, should also be allowed for at least the reasons presented above.

Newly Added Claims

Claims 32-35 have been added and are believed to be in allowable condition. Claim 32 depends from claim 1, claim 33 depends from claim 4, claim 34 depends from claim 5, and claim 35 depends from claim 14. Support for claims 32-35 is provided within the Specification, for example, is provided within

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the Specification, for example, in Figs. 5 and on page 12, lines 8-23. No new matter has been added.

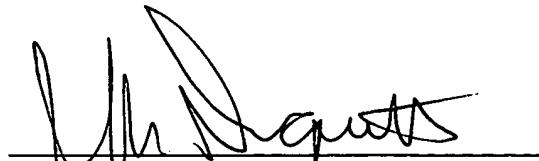
Conclusion

In view of the foregoing remarks, this Application should be in condition for allowance. A Notice to this affect is respectfully requested. If the Examiner believes, after this Amendment, that the Application is not in condition for allowance, the Examiner is respectfully requested to call the Applicant's Representative at the number below.

Applicants hereby petition for any extension of time which is required to maintain the pendency of this case. If there is a fee occasioned by this Amendment, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 50-3661.

If the enclosed papers or fees are considered incomplete, the Patent Office is respectfully requested to contact the undersigned collect at (508) 616-2900, in Westborough, Massachusetts.

Respectfully submitted,



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